Changes in Premature Mortality Due to HIV Infection in New Jersey during the 1990s

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Analyses of the patterns and trends in total deaths and death rates, both crude and age-adjusted, traditionally have been used to identify the relative importance of the various causes of death acting upon a given population. However, more than three-fourths of resident deaths occur in the population 65 years of age and older, and close to 60% occur in persons 75 years of age and older. Deaths in the older population heavily weight the crude death rate toward the mortality experience of the older group, both in terms of the death rate and the leading causes of death. Deaths among younger age groups are often subsumed under the mortality experience of the total population and not studied in detail.

Although never ranking higher than fifth as a cause of death among the total population, HIV infection was the leading cause of death in New Jersey residents aged 25–44 years from 1988–1996. In 1997 and 1998, the age-specific death rate from HIV infection fell to second or third rank in this age group, behind unintentional injuries and cancer.[1] In the nation as a whole, HIV infection was the leading cause of death among 25–44 year olds in 1995 and the sixth leading cause in 1998.[2,3] This article explores the effect of decreasing mortality rates from HIV infection on premature mortality measures in New Jersey during the decade that saw the introduction of antiretroviral and other therapies that had a profound effect on mortality from HIV infection.

METHODS

The most useful measure of premature mortality provides an analytical method that gives greater weight to the youngest deaths and uses a cut-off point for inclusion, such as the age of 65 or 75. A number of variations in approach to measuring premature mortality have been introduced over the past fifty years since the first attempts at analyzing premature death.[4,5] Definitions of the span of years encompassing premature death vary internationally and within the United States and have changed over time, in keeping with increasing life expectancy. For example, the State Center for Health Statistics in North Carolina used the summation of the remaining life expectancy for each resident who died as the measure of premature death in its recent publication.[6] The current method of assessing the impact of premature death used by the National Center for Health Statistics (NCHS) is a measure called years of potential life lost (YPLL), which is the weighted sum of years of life not lived prior to reaching the average life expectancy. Overall life expectancy in the United States is now approximately 75 years. For a detailed description of the method used to calculate the YPLL, see the Center for Disease Control and Prevention's (CDC) *Years of Potential Life Lost*.[7]

In order to be consistent with the data published by the NCHS, this article defines premature death as death occurring before the age of 75 and defines YPLL as a summary measure of all of the years of life not lived by persons who died before reaching the age of 75. YPLL gives heavier weights to deaths at young ages, than to deaths at older ages, up to the age of 75.

The underlying causes of death reported on the death records of New Jersey residents from 1990–1998 were used to calculate YPLL and to determine the causes of death that contributed the most to YPLL in

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The Public Health section of *New Jersey Medicine* is edited by Leah Z. Ziskin, MD, MS, senior deputy editor.

each of the years over the nine year period, with an emphasis on deaths from HIV infection. Deaths from HIV infection for the 1990–1998 period were defined by codes 042–044 from the International Classification of Disease (ICD), version 9.[8] The analysis was limited to years prior to 1999, which was the date for the introduction of the newest version of the cause-of-death classification system, ICD-10.[9] Because the change in classification systems leads to complications in analyzing data that spanned the years of the change from ICD-9 to ICD-10 (before 1999 and 1999 and after), this analysis is restricted to data using only ICD-9 classifications.

The causes of death were grouped into those published by the NCHS; the leading causes of death used in this study are consistent with and drawn from causes of death ranked by NCHS.[3] Among the basic principles NCHS uses in identifying these causes is the exclusion of vaguely defined categories and categories beginning with the words "other," "all other," "certain other," or "unspecified." Causes selected were not only those considered most useful from a public health perspective, but were required also to be mutually exclusive. Where possible, historical continuity across various versions of the ICD manual was maintained.

YPLL rates per 100,000 population under the age of 75 were computed for deaths from HIV infection so that comparisons could be made in YPLL over time and between subgroups of the population. Because the population distribution by age is changing over time, the YPLL rates were age-adjusted by the direct method, using the 2000 U.S. standard population. Age adjustment of rates is a modification technique, which removes the effect of the differences in age distributions over time and by place. This allows investigation of differences between rates due to factors other than age.

RESULTS

Cancer and heart disease were the first and second ranked causes of YPLL to age 75 in both 1990 and 1998 in New Jersey, although the order of the other leading causes did not remain consistent from 1990 to 1998. In 1998 the total number of years of potential life lost for each of the ten leading causes of death was smaller than that of 1990. The eleventh leading cause of YPLL in 1990, diabetes, included because it was among the top ten causes of YPLL in 1998, showed a slight increase from 1990 to 1998 (see table 1)

The relative decrease in YPLL over the nine-year period varied considerable by cause. The largest decrease (-59.3%) in years of potential life lost occurred in HIV infection. Major declines also occurred for premature deaths from congenital malformations, homicides, certain perinatal conditions, and cirrhosis and other chronic liver disease. HIV infection accounted for 9.0% of the total YPLL in New Jersey in 1990, but only 4.5% of the total in 1998. (See table 1.)

Age-adjusted overall YPLL and YPLL due to HIV infection in each year 1990–1998 are shown in table 2. For HIV infection, the change in age-adjusted YPLL rates (-60.4%) was approximately the same as the change in the raw numbers of YPLL (-59.3%) seen in table 1. The age-adjusted rate of YPLL increased each year from 1990–1995, but then dropped dramatically in each of the years from 1996 through 1998. Although the age-adjusted YPLL rates due to HIV infection in the country as a whole are lower than those in New Jersey, the national rate also decreased during this time period (383.8 per 100,000 in 1990; 175.4 per 100,000 in 1998).[10] This represents a change of –54.3% in the age-adjusted rate in the U.S., compared to a –60.4% decline in New Jersey.

The age-adjusted rates of YPLL from HIV infection were consistently higher for males than for females across the study period. However, the reduction in YPLL was also greater for males than for females (-63.3% vs.–52.2%) as was the decline in the age-adjusted YPLL from all causes of death (-22.1% vs.-18.5%), which was partially driven by the fact that the improvement in the HIV-infection YPLL rate over the period was greater in males than in females. (See table 3.)

The decrease in rates of premature death from HIV infection also varied by race. Rates by race are presented only for blacks and whites; Hispanics are included in each of the racial groups. While the black age-adjusted YPLL rate for all causes of death decreased at a greater rate than the comparable white rate (-29.8%

Table 1. Leading Causes of YPLL before Age 75 in New Jersey

CAUSE GROUP	YEAR 1990 YPLL	RANK	YEAR 1998 YPLL	RANK	CHANGE
Cancer	151,061.0	1	136,901.0	1	-9.4%
Heart Disease	107,579.5	2	92,186.5	2	-14.3%
HIV Infection	59,404.5	3	24,192.0	5	-59.3%
Unintentional Injury	56,502.0	4	54,821.0	3	-3.0%
Perinatal Conditions	43,114.5	5	30,281.5	4	-29.8%
Cong. Malformations	22,542.0	6	14,635.5	9	-35.1%
Homicide	20,643.5	7	13,873.5	10	-32.8%
Stroke	19,057.0	8	16,990.5	6	-10.8%
Suicide	17,167.0	9	16,487.0	7	-4.0%
Cirrhosis	15,035.5	10	11,012.0	11	-26.8%
Diabetes	14,740.5	11	14,941.0	8	1.4%
All Causes	662,337.5	N/A	542,620.5	N/A	-18.1%

Table 2. Age-Adjusted Rates of YPLL before Age 75 for HIV Infection, New Jersey*

	HIV INFECTION	ALL CAUSES
1990	771.6	8,871.0
1991	886.5	8,791.4
1992	884.7	8,704.4
1993	1,035.9	8,829.4
1994	1,075.4	8,748.5
1995	1,108.8	8,646.0
1996	779.3	8,047.2
1997	437.8	7,502.7
1998	305.8	7,041.5
Change	-60.4%	-20.6%

*YPLL per 100,000 population under 75 years of age, adjusted to the standard age distribution of the 2000 U.S. population

Table 3. Age-Adjusted Rates of YPLL before Age 75 for HIV Infection, New Jersey*

	HIV INFECTION 1990	HIV INFECTION 1998	HIV INFECTION CHANGE	ALL CAUSES 1990	ALL CAUSES 1998	ALL CAUSES CHANGE
MALE	1,157.2	424.4	-63.3%	11,435.2	8,906.2	-22.1%
FEMALE	402.4	192.4	-52.2%	6,476.4	5,278.1	-18.5%
WHITE	393.7	140.1	-64.4%	7,416.3	6,273.9	-15.4%
BLACK	3,209.0	1,368.3	-57.4%	18,466.5	12,954.3	-29.8%

*YPLL per 100,000 population under 75 years of age, adjusted to the standard age distribution of the 2000 U.S. population

vs.-15.4%), the YPLL rates for HIV infection declined more among whites than among blacks (-64.4% vs.-57.4%). (See table 3).

Discussion

The National Center for HIV, STD, and TB Prevention (NCHST), Divisions of HIV–AIDS Prevention, reports that, nationally, the number of deaths of persons with AIDS increased yearly from the time these deaths were first reported until 1995.[11] Although the estimated number of diagnosed cases of AIDS in adolescents and adults had been declining, the decrease in deaths from AIDS in 1996 and 1997 was greater than could be accounted for by the decrease in incidence of diagnosed cases. The decline in death rate is undoubtedly a result of the introduction of highly active antiretroviral therapy (HAART), which prevented the progression to AIDS-free for a longer time in HIV-infected persons and, therefore, extended their overall survival time. The CDC, in its recent supplemental surveillance report states that "highly active antiretroviral therapy (HAART) has been primarily responsible for declines in AIDS diagnoses and in deaths among persons with AIDS. . . ."[12] Improved prevention and treatment of opportunistic infections also contributed to the decreased morality.[13] Decreases in the number of deaths among persons with HIV–AIDS have been seen in all geographic and demographic groups in the nation, according to NCHST.

Only about 4% of the HIV-infection deaths of New Jersey residents in both 1990 and 1998 occurred in persons 75 years of age and over. Since almost all of the deaths due to HIV infection occur in persons under 75 years of age, the effect of the decrease in these deaths is a substantial reduction in YPLL. In New Jersey, there were more than twenty-five thousand years of potential life *not* lost in 1998 when the burden of YPLL due to HIV in 1990 is compared to that in 1998. This represents the weighted difference by age between the 1,637 deaths due to HIV infection in 1990 under the age of 75 and the 728 deaths under 75 in 1998. These are the potential years not lost for only one year since the introduction of HAART and could be summed for all of the years since 1996, the year in which the YPLL began to decline.

The survival of HIV-infected persons and the deferral of death for infected persons differ by gender and race in New Jersey. Since 1990 the YPLL rate for males has declined at a greater rate than for females (-63.3% vs. -52.2%). This may be due to the greater decline in intravenous drug use (IDU) as a mode of transmission for HIV infection and the relatively greater proportion of males for whom this is the mode of transmission.[14] The greater decrease in the age-adjusted YPLL rate in the white population compared to the black population is thought to be due to greater access to health care in the white population.[15] Major disparities between the black and white populations continue to exist in the death rates from HIV infection as measured by YPLL.

A major new strategy proposed by the CDC involves a transfer of focus in prevention to a "prevention for positives" campaign. This campaign encompasses identifying infected persons who are not aware that they are infected, getting them into treatment, and teaching them how to avoid passing their infections on to others.[16] All of these new strategies require funding, and the dollars needed may be even greater than current funding levels directed toward prevention in the general population and care and treatment of lower numbers of persons with HIV–AIDS. A recent article in the *Morbidity and Mortality Weekly Report* (*MMWR*)[16] outlining the new program suggests that the declines in morbidity and mortality from HIV infection due to combination antiretroviral therapy evident nationwide from the mid- to late-1990s may have ended. In response the CDC has changed the focus of some of its programs from primary prevention to persons living with HIV–AIDS. At the same time, the FDA approval and adoption of a program to implement a simple rapid HIV test presents an opportunity to overcome the barriers to early diagnosis and entry into treatment. The effect of these changes on the death rate from HIV infection and the median age at which those infected die are unknown at this time, but should be explored when additional data are available.

The decrease in premature death due to HIV in-

fection has an impact on the resources allocated for medications, treatment, prevention, and social services. There are now many more people living with HIV–AIDS in New Jersey and in the country as a whole. A major factor in maintaining the health of the infected population is the provision of antiretroviral therapy through the AIDS Drug Distribution Program (ADDP). The ADDP expenditures depend on the number of patients served and the cost of the medications provided. As people live longer, more funding is needed to provide eligible individuals with HIV-related medications. With combination antiretroviral therapy, there has been a shift from inpatient to outpatient care.[17] This suggests a need for more outpatient treatment resources and facilities as well as increased services for health maintenance.

Additional prevention resources are also needed as YPLL declines. The new CDC initiative, "prevention for positives," recognizes that to become infected, a person must be exposed to an already-infected person. With declining YPLL, a larger reservoir of infected people are living longer and, if not practicing proper prevention, can transmit HIV to others. Therefore, both infected and uninfected persons need prevention services.

In addition to the broader range of services required, more study is needed on the factors involved in the differential decreases in YPLL among males and females and among the black and the white infected populations. Information on why these groups have experienced differing decreases in their death rates is necessary to develop and implement prevention and treatment programs to further improve the gains that have been made since 1996. *NJM*

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